State of New Jersey Organic Waste - To - Transportation Fuel Initiative

USDOE – Natural Gas Vehicle Technology Forum

August 2nd -4th, 2005

Washington, D.C.

Demonstration & Commercialization Work at Rutgers EcoComplex

- Participants
  - Acrion Technologies
  - Mack Trucks
  - Air Products & Chemicals
  - Chart Industries
  - Waste Management
  - Burlington County
  - Brookhaven National Laboratory - USDOE

Demonstration & Commercialization Work at Rutgers EcoComplex (continued)

- Biogas cleanup technology that, for the first time, enables the production of pure, separate liquid methane and liquid carbon dioxide products.
- Liquid methane ⟶ LNG or CNG

Clean, renewable transportation fuels

Demonstration & Commercialization Work at Rutgers EcoComplex (continued)

- Business Plan
  - LNG Fuel production/ dispensing stations at landfills and field erected anaerobic digesters.

New Jersey Registered Refuse Trucks 2005

Collection Trucks

- Publicly Owned: 4,219 (NJ), 3,516 (NYC)
- Privately Owned: 5,418

9,637

Transfer Tractors

Privately Owned: 4,104

Diesel Fuel Utilization by New Jersey Refuse Collection Trucks

- 8,650 gallons/year/truck
- 83,360,050 gallons/year total

  (9,637 x 8,650)
- 25,000 miles/year/truck
- 2.9 miles/gallon

Diesel Fuel Utilization by New Jersey Refuse Collection Trucks

(continued)

- Lowest fuel efficiency of all vehicle types due to unique service duty.
  - Slow average speed of 10 mph
  - Constantly stopping & starting
  - Regularly compaction waste
  - Idling 70% of its operating time

Refuse Trucks and Air Quality

- Conventional diesel refuse trucks are a major source of air pollutants, including smog forming compounds, particulate matter and toxic chemical constituents.
- Refuse vehicles are the most polluting of all mobile sources.
- The refuse truck sector would benefit air quality more than any other by shifting from diesel to LNG.

Emission Reductions with LNG

- Particulate Matter – 67% - 99%
- Nitrogen Oxides – 32% - 73%
- Non-methane Hydrocarbons – 69% - 83%

Renewable LNG Fuel Potential In New Jersey

- Annual Diesel Fuel Consumption for Refuse Collection Trucks – 83,360,000 gallons
- Annual LNG Diesel Equivalent – 155,880,000 gallons
- 4.84 Million Tons Organic Waste/year in NJ
- Annual LNG Potential From Organic Waste – 52,884,000 gallons
- 34% of Fuel Needs Could Be Met

Pre-processing Organic Waste to Increase Biogas Yield and LNG Fuel Production

- Current technology for producing biogas from organic waste employs landfills and field erected anaerobic digesters
- These technologies yield only 11% of the stoichiometric, 100% biogas yield

  24,000 cf/ton vs 2,800 cf/ton

Pre-processing Organic Waste to Increase Biogas Yield and LNG Fuel Production (continued)

- Preprocessing the organic faction prior to digestion can increase biogas yields up to two fold.
  - Steam Pressure Disruption
  - Thermal Wet Oxidation
  - Dilute Acid Hydrolysis
  - Ultrasonic Treatment
  - Preprocessing is now economical due to the higher value of LNG verses electrical power.

Expand The Domain of Organic Waste to Increase LNG Production

- Agriculture Waste
  - Plant Residue
  - Animal Manures
- Food Processing Waste
- Fats, Oils and Grease
- Biosolids
- Industrial and Pharmaceutical Organic Waste
  - Liquids
  - Semi-liquids
  - Solids

Benefits of Producing LNG Fuel from Organic Waste

- Provides locally produced clean, renewable transportation fuel.
- Relatively fixed price of fuel over life of facility.

  10 – 15 years
- Assist State in reducing $PM_{2.5}$ and 8-Hour Ozone in its non-attainment areas and significantly improve local air quality.

Benefits of Producing LNG Fuel from Organic Waste (continued)

- Reduction of greenhouse gases:
  - 314,131 tons per year of carbon dioxide sequestered per year if 52,884,000 gallons of LNG displaced diesel.
- Improve water quality in estuaries by reducing nitrogen oxides which are a major source of nutrient loading to surface water.
- Increase state and local recycling tonnages.

New Elements Under Consideration by NJDEP for State Solid Waste & Air Quality Plans

1. Mobile Source Emissions Reduction Credit Program.
2. Products derived from biogas (LNG, CNG, Methanol, liquid carbon dioxide) would be considered recycled products and count towards the County and State recycling goals.

New Elements Under Consideration by NJDEP for State Solid Waste & Air Quality Plan (continued)

3. Technical assistance and educational outreach for solid waste hauling community to help transition to LNG.
4. Federal and State legislation designed to encourage and support field erected anaerobic digestion systems that produce transportation fuel and infrastructure for dispensing the fuel.
5. Establish permitting requirements for AD facilities.

New Elements Under Consideration by NJDEP for State Solid Waste & Air Quality Plan (continued)

6. Support co-digestion of MSW organic waste with other organic waste stream, including biosolids, agricultural, pharmaceutical and industrial organic waste.
7. Allow biosolids to be beneficially used in bioreactor landfills to increase gas yields.

New Elements Under Consideration by NJDEP for State Solid Waste & Air Quality Plan (continued)

8. Investigate, evaluate and demonstrate technologies which will increase biogas yields from anaerobic digestion.
9. Inventory and quantify all organic wastes generated in New Jersey which are suitable for processing into transportation fuels.
10. Initiate a regional and national dialogue on Progressive Ban on Biodegradable Waste in Landfills. (EU Landfill Directive)